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ABSTRACT

The purpose of this paper is to provide educators with information about mathematics anxiety. The focus is on characteristics, causes, and possible solutions for victims of this disorder. The first section of the paper provides a statement of the problem defines the purpose, organization, and limitations of the study, and includes a glossary. The second section presents an annotated bibliography, divided into three parts: (1) what is math anxiety (definition, characteristics, causes, and symptoms); (2) who experiences the effects of math anxiety (results and significant factors); and (3) are there solutions to the problem (reduction and elimination of math anxiety). In the third section, these studies and other papers are summarized, conclusions are drawn, and 11 recommendations are listed, directed for the most part toward teachers and other educators. A 36-item bibliography is included. (MNS)

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AN ANNOTATED BIBLIOGRAPHY OF MATERIAL DEALING WITH MATHEMATICS ANXIETY

by

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FORWARD

Assistance for completing this study, was provided by Roger Berebitsky's published research titled: "An Annotated Bibliography of the Literature Dealing with Mathematics Anxiety."

INTRODUCTION

Societal pressure has caused school systems to return to the "basics" of instruction. School curriculums are expected to include courses that prepare students for daily living, as well as life in future years due to technological advancements. Often, knowledge of mathematics is needed to pursue existing and emerging occupational fields in our culture. (Betz 441) Educational institutions are required to teach concepts necessary to meet this objective. For learning to occur, supportive teachers and healthy classroom climates are considered crucial to foster positive student attitudes toward mathematics. (Widmer and Chavez 276)

Unfortunately, positive attitudes are not possessed by students at all times. Student problems encountered by mathematics instructors vary depending on the situation. In many cases math anxiety has been the source of distress. Consequently, this emotional state is a critical factor in students' educational and vocational decisions which influence their career goals. (Betz 441)

Math anxiety has been the object of discussion and debate since numerous educators have recognized the disorder as a hinderance to learning mathematics. (Sherard 106) The problem has challenged individuals involved to find its origin, and develop methods to prevent its occurrence. Mathematics

anxiety does not affect victims identically. For example, gender and economic background might determine the degree anxiety is experienced in some people. (Burton 199) Other students may be handicapped due to unpleasant memories of classroom activities. (Tobias 27) If the problem becomes too severe, math anxious students will begin to avoid mathematics at all costs. (Morris 413) Without a doubt, anxiety traits displayed by students in mathematics courses must be a concern of teachers in this subject area.

STATEMENT OF PROBLEM

Many students have difficulty with mathematics courses. These problems affect an individual's ability to function properly and adequately apply fundamentals associated with mathematics. Student feelings, attitudes, and perceptions need to be understood. Therefore, mathematics anxiety experienced by students must be a concern of teachers in this field of education.

PURPOSE OF STUDY

The purpose of the study was to provide educators with information about math anxiety. Consequently, the study focused on characteristics, causes, and possible solutions for victims of the disorder. Also, it examined who may suffer from mathematics anxiety.

ORGANIZATION STUDY

The research was divided into three main sections. First of all, background information on math anxiety was presented. Characteristics, causes, and symptoms of the problem are explored. Secondly, the study examined who suffers from mathematics anxiety. The last part covered solutions that may ease, or eliminate the disorder.

LIMITATIONS

The study did not present definite remedies for solving problems related to mathematics anxiety. It merely offered a summarization of material connected to certain areas of this topic. Also, the paper did not, nor could not, encompass all research documented on math anxiety within the given time frame.

GLOSSARY

affective-- "students' feelings about mathematics aspects of the classroom, or about themselves as learners of math." (Reyes 1984:558)

cognition-- "in general, the process of knowing; in particular, the process of knowing based upon perception, introspection, or memory." (Good 1973:113)

effectance motivation-- "problem solving mind-set." (Chisholm 1980:49)

flounder constructively-- "what to do when you don't know what to do - how to keep going, try out new ideas, substitute different numbers, enlarge upon the problem, and thus hold at bay the ever present tendency to quit." (Tobias 1980:28)

learning style-- "manner in which many different elements from four basic stimuli (environment, emotional, sociological, and physical) affect a person's ability to absorb and retain." (Hodges 1983:18)

MARS (Mathematic Anxiety Rating Scale)-- "provides a measure of anxiety associated with the single area of the manipulation of numbers and the use of mathematical concepts." (Richardson and Suinn 1972:551)

MARS-A-- "revised form of the MARS that involves changes in some words or the substitution of new items appropriate for adolescents." (Suinn and Edwards 1982:577)

math anxiety-- "irrational dread of mathematics that interferes with manipulating numbers and solving mathematical problems within a variety of everyday life and academic situations." (Buckley and Ribordy 1982:1)

math avoidance-- "the natural consequence of a set of attitudes that develop as a result of a student's early educational experiences." (Kelly and Tomhave 1985:51)

physiological arousal-- "heart rate, skin conductance level, and spontaneous skin fluctuations." (Dew, Galassi, and Galassi 1983:581)

self-efficacy-- "expectations of personal effectiveness." (Hackett 1985:47)

test anxiety-- "fear of taking examinations; unpleasant emotional reaction elicited by anticipation of a testing situation; may have an affect on the test performance of the subject." (Good 1973:595)

ANNOTATIONS

WHAT IS MATH ANXIETY?
DEFINITION, CHARACTERISTICS, CAUSES, AND SYMPTOMS

Buckley, Patricia A., and Sheila C. Ribordy. "Mathematics Anxiety and the Effects of Evaluative Instructions on Math Performance." Paper presented at the Midwestern Psychological Association (Minneapolis, MN, May 6-8, 1982).

Math anxiety was defined as an irrational dread of mathematics that interferes with number manipulation and mathematical problem solving within everyday life and academic situations. Several conclusions were formed from the results of the research. It demonstrated that high levels of math anxiety produce debilitating effects on math test performance. Also, the study showed that individuals with minimal previous involvement in mathematics are prone to experience higher levels of math anxiety. Specific attention was given to male/female comparisons with regard to math anxiety. Even though females often report having had less exposure to mathematics than males, the levels of math anxiety appear to be quite similar between the sexes.

Tobias, Sheila. "Math Anxiety: Why is A Smart Girl Like You Counting On Your Fingers?" Ms. 5.3 (September 1976): 56-59+.

The author pointed out several causes and characteristics of math anxiety in females. According to Tobias, math anxiety is an emotional and cognitive problem which is handed down from mother to daughter. A mother's negative feelings toward mathematics, reinforced by a father's attitudes and comments, often manifest within the daughter's psyche. Math anxiety is associated with an "I can't" syndrome. People become frightened by math and avoid any course that uses numerical concepts, or notation of any sort. Words like "proportion," "percentage," "variance," "curve," and "exponential" create a feeling of fear in math anxiety victims. Often females change their educational career choices if they notice that mathematics plays a major role in their course selection. In addition, Tobias brought up several other possible causes for math anxiety. Poor guidance counseling, peer influence, and spatial relations play key roles in the development of math anxiety.

Gourgey, Annette F. "Development of a Scale for the Measurement of Self-Concept in Mathematics." 1982. Research Report, New York University.

In this study, a scale of twenty-seven items was constructed reflecting attitude toward the ability to learn math. The scale and several other measurement tools were administered to 92 students. Research findings from the instruments indicated that both children and adults may experience mathematics anxiety. The condition interfered with performance in math courses and created an impaired self-concept in mathematics.

Reyes, Laurie H. "Affective Variables and Mathematics Education." Elementary School Journal 84.5 (May 1984): 558-581.

The material covered in the article represented a condensed review of work completed by several individuals, including the author. Reyes offered information dealing with affective variables and their relationship to mathematics education. The term "affective" referred to a student's feelings and emotions about math, aspects of the classroom, or about themselves in an educational atmosphere. The author illustrated several ways affective variables are related to learning mathematical concepts. She stated that affective variables influence a student's willingness to work on a variety of tasks. The attitudes, feelings, and perceptions developed in this context may determine if a student chooses to pursue the study of mathematics. Specifically, the affective variables discussed in the article are the following: 1) confidence in learning math; 2) anxiety about mathematics; 3) attributions of success; 4) perceived usefulness of mathematics.

Chisholm, Carol "Correlates of Math Avoidance Responsible for Filtering Individuals from Math/Science Areas." June 1980. Master's Thesis, Townson State University.

The study identified factors relative to mathematics avoidance. Over 500 subjects from various occupational and geographical groups responded to the survey instrument (nine revised Fennema and Sherman Mathematics Attitude Scales). Results drawn from the data proved informative. The largest predictor of mathematics avoidance was effectance motivation. This trait can be described as a passive attitude toward math. It develops when a person has learned that he/she is helpless in situations utilizing numbers. Other predictors of mathematics avoidance included were 1) confidence in learning; 2) perceived usefulness of math; and 3) math anxiety.

Resnick, Harvey, John Viehe, and Sanford Segal. "Is Math Anxiety a Local Phenomenon? A Study of Prevalence and Dimensionality." Journal of Counseling Psychology 29.1 (January 1982): 39-47.

Resnick, Viehe, and Segal investigated the prevalence of math anxiety among 1,106 college freshman at the University of Rochester during the fall of 1979. Besides examining the presence of math anxiety, the researchers examined its relationship with differences in gender and mathematics achievement. An analysis of the findings demonstrated lower levels of math anxiety for the students in this study than at other institutions. The study noted approximately equivalent levels of math anxiety for men and women. Other conclusions from the research were: 1) few students in the sample had more than "a little" math anxiety, 2) math anxiety is most prevalent among students not adequately prepared in mathematics, 3) math anxiety measures are no more important than past math performance and preparation for predicting future success, and 4) no relationship could be established to support the belief that successful math students are more introverted (less sociable) than those with talent in other areas of education.

Alexander, Livingston, and Robert Cobb. "Identification of the Dimensions and Predictors of Math Anxiety among College Students." Paper presented at the Annual Meeting of the Mid-South Educational Research Association (New Orleans, LA, November 16, 1984).

The study attempted to determine if math anxiety is a unidimensional, or multidimensional construct. Research found two meaningful dimensions: 1) Math Test Anxiety, and 2) Numerical Task Anxiety. Findings indicated that apprehension about taking tests and receiving evaluations should seriously be considered components of math anxiety. Data showed students likely to experience math anxiety in college had performed poorly in high school courses and were inadequately prepared for advanced study in mathematics.

Rounds, James B. Jr., and Darwin D. Hendel. "Measurement and Dimensionality of Mathematics Anxiety." Journal of Counseling Psychology 27.2 (March 1980): 138-149.

Rounds and Hendel conducted a study on mathematics anxiety at a large midwestern university beginning in the spring of 1976 and ending during the winter of 1978. Their research results were similar to several other studies. The data they collected suggested that mathematics anxiety is a phenomenon not limited to females, but is prevalent among students poorly prepared in mathematics. The extreme difference between female and male enrollment in math courses is due to factors other than mathematics anxiety. Also, Rounds and Hendel found reduction in anxiety was not related to grades. Lastly, moderate-to-high relationships exist between mathematics anxiety, test anxiety, and attitudes toward the study of math.

Tobias, Sheila. "Math Anxiety: What You Can Do About It." Today's Education 69.3 (September - October 1980): 26-29.

At Wesleyan University, a math clinic staffed by counselors and mathematics instructors studied the source of fear, hostility, and alienation directed toward math courses. From the analysis of the research collected, certain causes and characteristics of math anxiety were recognized. It seemed good and poor students felt mathematics aptitude was a genetic gift rather than a set of skills which were learned, practiced, and developed. Many times students witness others solving math problems instantly. Consequently, they panic if they are unable to do so and stop working. These students fail to try different approaches to solve the problem. They do not learn to flounder constructively through a problem and obtain a solution. This attitude may be found especially in female students since most people think math is a male oriented domain.

Along with these findings, several other characteristics were discovered from the research examined. People who suffer some degree of math anxiety possess limited spatial skills. Also, terminology related to the study of mathematics can be a hinderence. Certain words and phrases have many connotations and seem ambiguous. Lastly, stress created by various classroom activities can be a determining factor. Unpleasant memories of timed tests, frequent quizzes, excessive competitiveness, and "blackboard stupidity" may be evident in people experiencing math anxiety.

Hackett, Gail. "Role of Mathematics Self-Efficacy in the Choice of Math-Related Majors of College Women and Men: A Path Analysis." Journal of Counseling Psychology 32.1 (January 1985): 47-56.

The research tested the hypothesis that mathematics-related self-efficacy influences an individual's choice of study at the college level. Data from a series of inventories and questionnaires was collected from 117 (72 females, 45 males) undergraduates. An analysis of the information pointed out the following conclusions. First of all, gender-related socialization factors, in combination with mathematics preparation, predicted a person's level of mathematics achievement. Math self-efficacy, when influenced by these previous variables, dictates levels of math anxiety and affects math-related major choices. Secondly, other characteristics were found to produce certain attitudes and behaviors in high school students. These traits ranged from socioeconomic status and parental background to the influence of teachers and school systems. In addition, based on the results obtained, the study stated that math anxiety may not contribute to an individual's choice of college major in an area related to mathematics.

Oberlin, Lynn. "How to Teach Children To Hate Mathematics." School Science and Mathematics 82.3 (March 1982): 261.

The author stated that children normally do not dislike mathematics when they start school, it is a trait they acquire during their elementary years. Several methods for accomplishing this feat are utilized by teachers. Some of these techniques and procedures can be used individually, or in combination. They include assigning the same work to everyone in the class, covering the book problem by problem, giving written work everyday (especially over weekends and holidays), and insisting there is only one correct way of solving a problem. Other instructional mistakes made by teachers include assigning math problems as punishment for misbehavior, using long drill type assignments with many examples of identical problems, assigning all students review work throughout the book, and insisting that every problem worked incorrectly be reworked until it is correct. Teaching methods of this kind enhance frustration, humiliation, and bordom. Students' creativity is eliminated and a general dislike for math is promoted.

Sovchik, Robert, L. H. Meconi, and Evelyn Steiner. "Mathematics Anxiety of Preservice Elementary Mathematics Methods Students." School Science and Mathematics 81.8 (December 1981): 643-648.

The authors stated that greater communication between mathematics educators and personnel trained in the area of psychology must be initiated to clarify the meaning of "math anxiety." They found meager amounts of literature covering mathematics anxiety compared to psychological reports on anxiety in general. For clarification purposes, a list of proximal consequences of anxiety developed by Phillips, Martin, and Meyers (1972) was suggested to serve as a foundation for constructing a behavioral list of mathematics anxiety symptoms. Behavioral checklists might prove useful in teaching, or other experimental situations. According to Phillips, Martin, and Meyers the following list of proximal consequences of anxiety might prove useful for the identification of anxiety symptoms. The behaviors witnessed are: 1) cautiousness, perservation, rigidity, and dependency; 2) reduced responsiveness to the environment; 3) increased drive or motivational level; 4) interference with numerous cognitive and mediational processes; 5) helplessness; 6) compulsive behaviors; and 7) poor self-image.

Dew, K. M. Harriss, John P. Galassi, and Merna D. Galassi. "Math Anxiety: Relation with Situational Test Anxiety, Performance, Physiological Arousal, and Math Avoidance Behavior." Journal of Counseling Psychology 31.4 (October 1984): 580-583.

Research was conducted to assess the relationship between mathematics anxiety and the following: test anxiety, math performance, physiological arousal, and math avoidance behavior. Sixty-three undergraduates (23 men, 40 women) were used for the study. Findings indicated that math and test anxiety are related, but not identical. Also, there was a slight connection between anxiety and math performance. Surprisingly, physiological arousal and avoidance behaviors showed little relationship to math anxiety.

Brush, Lorelei R. "Some Thoughts for Teachers on Mathematics Anxiety." Arithmetic Teacher 29.4 (December 1981): 37-39.

One of the best tests for measuring math anxiety and avoidence is the Mathematics Anxiety Rating Scale (MARS). The MARS has a list of ninety-four situations which must be rated. The situations are broken down into two groups: calculations, and experiences involving evaluation by others. Of the two groupings, students feel most anxious in situations which require evaluation by someone else.

A study of 1500 students from three New England school systems (one urban, one suburban, one rural) was used to formulate these conclusions. The findings presented several features of mathematics that students observe, dislike, and find increasingly anxiety-provoking as they progress through their education. They are: 1) mathematics gets difficult (abstract) in the early years of school; 2) students spend time learning what is already known and less time contributing their own ideas; 3) after arithmetic, everyday uses for the material learned in class appears limited; and 4) working with numbers does not seem to contribute to a better understanding of oneself, or society (the subject is impersonal).

WHO EXPERIENCES THE EFFECTS OF MATH ANXIETY? RESULTS AND SIGNIFICANT FACTORS

Betz, Nancy E. "Prevalence, Distribution, and Correlates of Math Anxiety in College Students." Journal of Counseling Psychology 25.5 (September 1978): 441-448.

Betz presented research designed to investigate factors related to the prevalence and intensity of math anxiety in college students. The determination to which levels of math anxiety differ as a function of sex, age, and prior mathematics preparation were of special interest. For the purpose of conducting the study, the author used several testing instruments including a version of the Fennema-Sherman Mathematics Anxiety Scale. The following results were obtained from analizing the study: 1) in general, females reported higher levels of math anxiety than males; 2) levels of mathematics anxiety were found to be related to the age of female students; 3) anxiety for math corresponded to the amount of course involvement during high school for both sexes; 4) there is an association between high levels of math anxiety and low achievement scores in mathematics.

Llabre, Maria M., and Edwardo Suarez. "Predicting Math Anxiety and Course Performance in College Women and Men." Journal of Counseling Psychology 32.2 (April 1985): 283-287.

The influence of mathematics anxiety on grade prediction for an introductory algebra course was examined in a survey of 184 college students (112 women and 72 men). Specifically, the purpose of this study was as follows: 1) determine if math anxiety differentially predicted performance in males and females after controlling for math aptitude; 2) discover the extent to which math anxiety may be differentially explained in terms of general anxiety or achievement motivation measures in males and females; and 3) distinguish if the degree of stereotyping math as a male dominated field of study can explain the level of mathematics anxiety in men and women.

Results of the research indicated the construct of math anxiety does not significantly improve the prediction of grades for either men or women. Once students have enrolled in a course, the level of math anxiety reported has little influence on the final grade received. Also, research suggested that math anxiety is less specific in males than females. One of the testing instruments, the MD scale (Mathematics as a Male Domain), indicated that math anxiety could not be predicted with a great deal of accuracy. Finally, results showed that women reported higher levels of math anxiety than men.

Dew, Kathleen H., John P. Galassi, and Merna D. Galassi, "Mathematics Anxiety: Some Basic Issues." Journal of Counseling Psychology 30.3 (July 1983): 443-446.

Dew, Galassi, and Galassi, examined the presence of mathematics anxiety in men and women. Their study was conducted at the University of North Carolina-Greensboro where 769 students participated in the research activities (550 women, 209 men, and 10 students who did not specify gender). The instruments used to conduct the study were the Mathematics Anxiety Rating Scale (MARS), the Fennema-Sherman Mathematics Anxiety Scale (MAS), the Sandman Anxiety Toward Mathematics Scale (ATMOS), and the Test Anxiety Inventory (TAI). The authors formulated the following conclusions from their findings: 1) on all measures, women displayed more anxiety than men; 2) gender differences in math anxiety exist, but are probably smaller than previously stated in other studies; 3) mathematics anxiety and test anxiety are related to a degree, but they are not synonymous.

Wright, Donald E., and Loretta Diane Miller. "Math Anxiety: A Research Report." Paper presented at the Annual Meeting of the Mid-South Educational Research Association (Lexington, KY, November 10, 1981).

Wright and Miller presented several viewpoints and facts about mathematics anxiety. They stated that mathematics is the primary root of all evil, with regard to students and their search for a career. This belief is especially true for females. Our culture begins to condition young ladies at the age of thirteen that mathematics is not a feminine career to pursue. But, math anxiety is not limited to the female gender. It is impartial and can influence the path of anyone's life. Therefore, teachers play an important role in determining the type of experience the student encounters. Wright and Miller concluded by stating that math anxiety is a severe problem facing society. It threatens the intellectual development of our culture.

Kelly, William P., and William K. Tomhave. "A Study of Math Anxiety/Math Avoidance in Preservice Elementary Teachers." Arithmetic Teacher 32.5 (January 1985): 51-53.

Kelly and Tomhave conducted research during the 1980-81 school year at the University of Minnesota, Morris, concerning math anxiety and avoidance among preservice elementary teachers. The study examined freshmen with no college preparatory mathematic courses; freshmen enrolled in college algebra; a group of students enrolled in a workshop for math anxious students; and forty-three elementary education majors where only six had gone beyond college algebra in their mathematics preparation. To determine levels of anxiety, the Mathematics Anxiety Rating Scale (MARS) was used. The ninety-eight item rating scale allows students to rank situations involving numbers in terms of stress produced. High point totals indicate proportionate levels of math anxiety. The following conclusions were noted: 1) on the average, elementary education majors scored higher on the MARS than any other group except those students in the math anxious workshop; 2) elementary males scored lower than any other group; 3) elementary education females scored higher on the MARS than any other group except those in the math anxious workshop; and 4) in most cases, elementary education subgroups scored higher on the MARS than any other group except the math anxious workshop students.

Fulkerson, Katherine F., John P. Galassi, and Merna D. Galassi. "Relation Between Cognitions and Performance in Math Anxious Students: A Failure of Cognitive Theory?" Journal of Counseling Psychology 31.3 (July 1984): 376-382.

This study focused on three specific questions: 1) How do cognitions vary as a function of mathematics anxiety during problem solving? 2) Do cognitions of men and women differ when solving the math problem? and 3) What is the extent of variation in mathematics performance with regard to differences in cognitions? The results of the research conducted for the first and second question disputed previous findings of several other studies. First of all, cognitions that may occur to an individual while he/she is solving mathematical problems do not differ as a function of math anxiety. Secondly, the findings of this study indicated that there is no difference in cognitions for men and women when solving problems related to math. Similarly, the results for the third question were different than expected. The study found that math anxiety was not significantly related to math performance.

Schofield, Hilary L. "Sex, Grade Level, and the Relationship between Mathematics Attitude and Achievement in Children." Journal of Educational Research 75.5 (May/June 1982): 280-284.

Data on the mathematics attitudes and achievement of elementary school children was gathered twice during the school year in this study. Relationships between attitude and success were considered in connection with sex of the student, grade level, type of achievement test, and time during the school year when measurements were taken. From the findings, it seemed that the relationship between attitude and achievement varied according to numerous factors. In regard to previous studies, the observed relationships among attitude and achievement were markedly stronger in these areas: 1) boys of all grade levels compared to girls of all grade levels; 2) the assessment of computational skills compared with conceptual skills, especially for boys in Grade 4 through 6; and 3) late during the school year compared with early in the school year (mainly for boys).

Siegel, Ross G., John P. Galassi, and William B. Ware. "A Comparison of Two Models for Predicting Mathematics Performance: Social Learning Versus Math Aptitude-Anxiety." Journal of Counseling Psychology 32.4 (October 1985): 531-538.

This study contrasted two models for predicting mathematics performance of 143 undergraduates at the University of Maryland. The models compared focused on social learning theory variables and math aptitude-anxiety variables. Social learning variables included situationally specific mathematics skills (previous exam grades), incentives, self-efficacy expectations, and outcome expectations. Math aptitude-anxiety variables were general mathematics ability (quantitative score of the Scholastic Aptitude Test), gender, sex role orientation, and mathematics anxiety. Results showed that social learning theory variables influenced math performance greatly. The study found that only variables from the social learning theory model accounted for variance beyond those of situationally, or generally defined math skills. It concluded that none of the variables in the math aptitude-anxiety model explained significant amounts of variation above mathematics ability.

Burton, Grace M. "Revealing Images." School Science and Mathematics 84.3 (March 1984): 199-207.

The author examined sex and race disparities of student participation and achievement in secondary mathematics courses. Burton's study presented evidence that participation and achievement influence career choices, especially for females and minority students. The conclusions are supported by students who were surveyed for their perceptions and attitudes toward their course of study. Many adolescents believed mathematics will be useful for future success. However, this viewpoint decreases primarily among female and minority students. A result of this attitude is discontinued study of mathematics courses. According to Burton's findings, a person was likely to further their study of math if they possessed certain opinions about the "ideal math student." These opinions included the following perceptions: 1) always completes homework; 2) concern with grades; and 3) knows main concepts of the course in question.

Fennema, Elizabeth, and Thomas P. Carpenter. "Sex-Related Differences In Mathematics: Results From National Assessment." The Mathematics Teacher 74.7 (October 1981): 554-559.

The purpose of the article was to report the sex-related differences found in the 1978 national assessment of math performance. Students aged 9, 13, and 17 were tested for the study. Assessment results indicated little difference in performance for males and females at the ages of 9 and 13. However, at age 17, females do not achieve at the same level as males. It was discovered that male results exceeded those of females at every cognitive level examined. Even in situations where each gender enrolled in identical courses, female performance was lower. This fact was especially true for mathematical tasks of higher complexity. Also, the authors stated that female participation in advanced math courses is less than male envolvement by one-third. This may explain why fewer women participate in university majors and careers which require a strong background in mathematics.

Widmer, Connie C., and Annette Chavez. "Math Anxiety and Elementary School Teachers." Education 102.3 (Spring 1982): 272-276.

Information for this research was collected from elementary school mathematics teachers in five northern Kentucky counties. Inventories were distributed to 500 teachers, and 230 of those returned were considered useable for the study. The survey investigated the relationship between math anxiety and four other characteristics of the teacher: sex, career inhibition, type of educational training, and recency of training. The results showed no significant relationship concerning sex and math anxiety. Subjects classified as math anxious displayed evidence of inhibited career goals more than those considered non-anxious. The data demonstrated that teachers who believed their mathematics training stressed understanding exhibited less math anxiety than those who identified their training as having focused on computation. Finally, the study showed no significant trends among math anxiety and the recency of educational training.

ARE THERE SOLUTIONS TO THE PROBLEM? REDUCTION AND ELIMINATION OF MATH ANXIETY

Sherard, Wade H. "Math Anxiety in the Classroom." The Clearing House 55.3 (November 1981): 106-110.

Sherard presented eight suggestions and procedures which may be used effectively by any teacher for eliminating math anxiety. The first is to avoid sex role stereotyping of mathematics as a male domain. It may cause females to allienate themselves from courses of study involving mathematics. Secondly, students must be aware of the everyday usefulness of mathematics, especially for future plans and careers. Thirdly, help students develop self-confidence in their ability to do math. Teachers can accomplish this goal by expressing confidence in students' abilities. Also, students should be encouraged to trust their intuition and first impressions when doing mathematics. Self-confidence will improve when individuals notice these perceptions are normally correct. Next, educators must concentrate on problem solving, spatial skills, language, and symbolism of mathematics as part of its curriculum. This idea is closely tied to the fifth suggestion which stated that teachers must be aware of the negative effects testing may have on attitudes toward math.

In conclusion, the last three suggestions are related to teaching techniques. They state that teachers should avoid behaviors which are inflexible and insensitive to student feelings. In other words, the classroom atmosphere must be relaxed and supportive.

Morris, Janet. "Math Anxiety: Teaching To Avoid It." Mathematics Teacher 74.6 (September 1981): 413-417.

Strategies and constructive techniques for teachers were suggested in the article to help prevent math anxiety. The first idea discussed was the creation of a positive, supportive classroom atmosphere. For this to occur, teachers must demonstrate a willingness to listen intently when student questions are asked. When explanations are given, they must be free of ridicule. Students should not feel they are asking a "dumb" question. Teachers must develop a climate where risk taking is acceptable. Educated guessing should be reinforced positively through certain teaching methods.

Teachers must stress understanding the thought process. Students should realize there are numerous ways a "right" answer can be discovered. Instruction and assignments dealing with processes and applications are more valuable than those requiring only memorization. Also, teachers need to dispel the "math mind" myth. Educators should point out to students that problems with mathematics are experienced by everyone. When teachers encounter problems during class they should try to work through them at that time. This shows students that perserverance, application, and thought are necessary qualities for finding solutions.

Along with the topics previously mentioned, the author provided several additional ideas for preventing math anxiety. They included providing new math experiences which cover concepts not normally studied. This might deal with implementing concrete materials to teach subject content. Also, material should be understood before moving on to something new. Lastly, reduce tension and pressure in class by eliminating activities like timed tests and individual blackboard work. When tests are given, look for ways to provide positive reinforcement even though answers may be incorrect.

Hodges, Helene L. B. "Learning Styles: Rx for Mathophobia." Arithmetic Teacher 30.7 (March 1983): 17-20.

The information presented by Hodges examined reasons why some youngsters succeed in mathematics, while others fail. Reasons ranged from anxiety, fear and frustration to the existence of indifference and avoidence. Hodges believed these characteristics lead to an illness called "mathophobia."

In order to prevent the development of mathophobia, "learning styles" should be taken into consideration. Every individual has a specific learning style best suited for their personality. Students learn faster and with less effort when taught through their particular learning style.

By definition, learning style is the manner in which eighteen different elements from four basic stimuli affect a person's ability to absorb and retain. The four basic stimuli are environment, emotional, physical, and sociological. Therefore, success or failure in mathematics may be related to the way material is presented rather than the subject itself. Studies have shown that students possess positive attitudes and better grades when taught in a manner conducive to their style of learning.

Wood, Dorothy F. "The Fourth R-Wrong." The Mathematics Teacher 75.9 (December 1982): 728-730.

Wood stated that students are frustrated and insecure with mathematics due to the "ease" wrong answers can be obtained. A "cohesive wholeness" to problem solving does not exist due to the structure of many mathematic concepts and operations. For example, when multiplying 18 by 27 the student may know that 2 x 8 = 16. However, if the product of 7 x 8 is incorrect, a sense of failure may develop within the student.

Elimination of personal frustration and insecurity toward mathematics results when students are taught to cope with being wrong. Three approaches used in applied psychology prove beneficial. First, verbal recognition of mistakes, and the frequency they occur, must be accomplished. Secondly, when a student is guilty of an error, gloating must be discouraged. Lastly, students must understand the consequences of mistakes. Errors are normal, but the results may be severe if others are involved.

Cartledge, Carolyn M. "Improving Female Mathematics Achievement." 1984. Research Report, Columbus College.

Cartledge mentioned the increasing importance of mathematics in our society. With this ocurrence, people have expressed growing amounts of anxiety and avoidance for mathematics. These attitudes are especially true of females. Their negative attitudes hinder career goals for obtaining numerous positions in certain vocations and professions. In comparison to males, females differ in spatial ability, math anxiety, attitudes toward mathematics, and the amount of math studied. According to Cartledge, these female deficiencies can be reduced, or eliminated by improving the awareness of parents, teachers, and students.

Bander, Ricki, S., Richard K. Russell, and Kathy P. Zamostny. "A Comparison of Cue-Controlled Relaxation and Study Skills Counseling in the Treatment of Mathematics Anxiety." Journal of Education Psychology 74.1 (February 1982): 96-103.

Research was designed to determine the effects of these intervention strategies for reducing mathematics anxiety and improving performance in college students. The groupings used for the study were (a) mathematics study skills training, (b) cue-controlled relaxation in an environment of study, (c) combined treatment using both of the above, and (d) a no-treatment control condition.

Thirty-six students were randomly assigned to one of the groups. A summary of results directly after treatment indicated that (a) study skills improvement and direction was the most effective condition for reducing self-reported math anxiety, and (b) the study skills and combination groups showed greater improvement than relaxation and no-treatment groups with math performance. However, a follow-up report several weeks after post-treatment revealed that the relaxation condition was superior to the study skills and combination groups for decreasing math anxiety and improving math performance.

Bulmahn, Barbara J., and David M. Young. "On the Transmission of Mathematics Anxiety." Arithmetic Teacher 30.3 (November 1982): 55-56.

The authors stated that a child's early exposure to mathematics, with regard to quality and nature of occurrence, is important. Numerous studies conducted on math anxiety agreed that environment effects mathematical interest and ability. The environmental aspect encompasses a student's interaction with his/her elementary school teacher. This relationship determines the early development of the student's math environment.

According to the article, a survey of approximately 200 college students showed a strong tendency toward fields of study other than mathematics. Half of the students polled were prospective elementary school teachers (ninety percent of the elementary education majors were women). Many of these students felt elementary school teachers needed little expertise in mathematics beyond basic computations, and fear of word problems was especially evident. To eliminate the transmission of math anxiety from teacher to student, the authors felt mathematics specialists could be utilized for teaching these courses at the elementary level.

Anick, Constance M., Thomas P. Carpenter, and Carol Smith. "Minorities and Mathematics: Results From The National Assessment Of Education Progress." The Mathematics Teacher 74.6 (September 1981): 560-566.

The results of the assessment documented the serious inequities which exist in the mathematics education of black and Hispanic students. Conclusions drawn by the assessment suggest that motivation is not a major concern. Students appear to recognize the importance of mathematics and want to continue their study in this field. Despite this attitude, the data gathered indicates a serious discrepancy toward black and Hispanic enrollment in mathematics courses. The information displayed the strengths and weaknesses of minority students compared to those of students in general. These results have definite instructional implications. Goals for improving the performance of minority students should not be based on the current standards of achievement in the nation. They must be established on what should be learned, not what is currently being learned.

Richardson, Frank C., and Richard M. Suinn. "The Mathematics Anxiety Rating Scale: Psychometric Data." Journal of Counseling Psychology 19.6 (November 1972): 551-554.

Mathematics anxiety involves feelings of tension and anxiety which interfere with the manipulation of numbers and the solving of mathematical problems in ordinary life and academic situations. Consequently, the problem may prevent students from passing fundamental mathematics courses, or prevent the pursuit of advanced courses in math. The Mathematics Anxiety Rating Scale (MARS) was constructed to provide a measure of anxiety with respect to the manipulation of numbers and the use of mathematical concepts.

The MARS is a 98-item scale composed of brief descriptions of behavioral situations that arouse various levels of anxiety in students. This instrument can be used in treatment or research. Validity of the MARS has been based on conclusions from several studies.

Suinn, Richard M., and Ruth Edwards. "The Measurement Of Mathematics Anxiety: The Mathematics Anxiety Rating Scale For Adolescents--MARS-A." Journal of Clinical Psychology 38.3 (July 1982): 576-580.

The relationship between mathematics anxiety and mathematics competencies has been recognized as an important clinical topic. Anxiety contributes to mathematics avoidance behaviors and interferes with individual performance. Numerous studies have examined the prevalence of mathematics anxiety among individuals. Measurement and recognition of this problem is necessary. The MARS-A is a useful diagnostic assessment instrument for identifying students in need of help. The instrument (a variation of the MARS) is a 98-item scale that lists a variety of life situations adolescents may experience when dealing with numbers. Students indicate the level of anxiety or stress associated with these activities on a 5-point scale. A low score indicates minimal anxiety, while a high score points toward extreme amounts of tension for mathematics.

The MARS-A can be utilized by junior and senior high counselors for directing students in career planning. Also, the instrument may answer questions concerning student performance in certain fields of study associated with mathematics.

SUMMARY

Buckley and Ribordy defined math anxiety as an irrational dread of mathematics that interferes with number manipulation and mathematical problem solving within everyday life and academic situations. Tobias' research suggested a similar description of math anxiety in her examination of female attitudes toward mathematics. She stated that math anxiety is an emotional and cognitive problem associated with an "I can't" syndrome manifesting fright of numerical concepts and notation.

Gourgey found mathematics anxiety to be a phenomenon experienced by people of all ages. She said the condition interfered with performance in math courses and created an impaired self-concept. Reyes presented several characteristics of mathematics anxiety similar to those discovered by Chisholm. Each noted evidence related to confidence in learning math and perceived usefulness of mathematics as characteristics of the individuals studied. Inadequate preparation was a trait believed by Resnick, Viehe, and Segal to contribute feelings of anxiety toward mathematics. Alexander and Cobb expanded on this idea stating college students most likely to experience math anxiety had performed poorly in high school and were unprepared for advanced study in mathematics. In addition, Rounds and Hendel agreed poor preparation in mathematics was characteristic of math anxiety

sufferers. Tobias mentioned failure by students to "flounder constructively" through problems in hope of finding solutions.

Causes for math anxiety, according to Hackett, ranged from socioeconomic status and parental background to the influence of teachers and school systems. Oberlin discussed the following teaching techniques as causes for math anxiety: 1) assigning the same work for everyone; 2) covering the book problem by problem; 3) giving written work everyday; 4) insisting on one way to correctly complete a problem; and 5) assigning math problems as punishment for misbehavior.

Sovchik, Menconi, and Steiner presented symptoms experienced by individuals possessing some level of math anxiety. The behaviors witnessed were: 1) cautiousness; 2) reduced responsiveness to the environment; 3) increased drive, or motivational level; 4) helplessness; 5) poor self-image; 6) compulsive behaviors; and 7) interference with cognitive patterns. In research completed by Dew, Galassi, and Galassi, symptoms they expected to encounter never materialized. They found only a slight relationship between physiological arousal, math avoidance, and math anxiety. The explanations given by Brush for development of math anxiety symptoms within students were as follows: 1) mathematics becomes difficult during early years of school; 2) students spend excessive amounts of time "learning" what is already known; and 3) students are not exposed to the everyday applications of the material covered.

In regard to gender and its link to math anxiety, Betz found females generally report higher levels than males. Also, she reported mathematics anxiety corresponded to previous math course involvement for both sexes. Llabre and Suarez conferred with Betz when comparing levels of math anxiety among males and females. Similarly, Dew, Galassi, and Galassi believed women displayed more math anxiety than men. Wright and Miller supported this belief in their study of math anxiety too. Kelly and Tomhave observed identical findings in their research on preservice elementary school teachers. Once again, males had lower levels of math anxiety compared to females.

With respect to mathematics problem solving, Fulkerson, Galassi, and Galassi uncovered no significant differences between the sexes. Schofield's study on elementary school children stressed attitude and achievement was stronger in boys. Siegal, Galassi, and Ware stated gender and sex role orientation were not as important as general mathematics ability for successful math experiences.

Research by Burton offered evidence that math participation and achievement influenced career choices, especially for female and minority students. Wright and Miller stated society conditions females (as early as thirteen years of age) to think math is not a feminine career choice. Fennema and Carpenter mentioned women do not participate in university majors

and careers which require a strong background in mathematics. In a poll conducted by Widmer and Chavez, teachers displaying qualities of math-anxiousness felt their career goals and objectives had been inhibited by mathematics anxiety.

Sherard presented suggestions for solutions to decrease math anxiety. They are: 1) avoid sex role stereotyping; 2) make students aware of daily uses for mathematics; 3) help develop student self-confidence; 4) encourage students to trust their intuitions when doing math; 5) educators must concentrate on problem solving, spatial skills, language, and symbolism as part of the curriculum; and 6) teachers must avoid behaviors inflexible and insensitive to student feelings. Solutions discussed by Morris included: 1) creation of a positive and supportive classroom atmosphere; 2) teachers should stress understanding the thought process of problem solving; 3) educators must point out nearly everyone experiences difficulties in math at one time or another; 4) students should be exposed to math situations not normally studied; 5) students must understand the material covered before teachers move on to new topics; and 6) eliminate timed tests and individual blackboard work. In research conducted by Hodges, support was given for teaching toward individual learning styles to decrease levels of math anxiety. Wood recommended teachers utilize three approaches from applied psychology. They must improve verbal recognition

of mistakes, discourage gloating when someone commits an error, and help students understand the consequences of their mistakes. Cartledge stressed increased awareness by parents, students, and teachers to reduce math difficulties. Research by Bander, Russell, and Zamostny supported methods of improving mathematics study skills and cue-controlled relaxation during periods of learning. On the other hand, Bulmahn and Young promoted use of mathematics specialists for teaching when instructors are not qualified to do an adequate job. Anick and Carpenter felt new goals should be established nationally so relevant concepts are taught. They stated that it was especially necessary for minority students.

Richardson and Suinn believed the MARS (Mathematics Anxiety Rating Scale) could be used to determine the type of treatment necessary for students suffering from math anxiety. Also, Suinn and Edwards discussed the implementation of the MARS to pinpoint areas of concern in student performance which may be linked to math anxiety.

CONCLUSIONS

Math anxiety is a mental, emotional, or physical disorder affecting a person's academic performance and general well-being. It is not selective. People of any age, sex, race, or social status may be victims of mathematics anxiety. There are various explanations for its development. Reasons range from parental attitudes to teacher behaviors and methods of instruction. Each situation is unique and numerous variables play a part in the formation of math anxiety.

Stress and tension created by math anxiety not only handicaps learning, but interferes with career planning and educational goals also. These facts are especially true for females. Attitudes of women are molded at an early age to view careers in mathematics as "unfeminine." Consequently, many females never reach their potential in math, or become involved in careers suitable for their abilities.

Suggestions have been presented to promote the elimination, or "easing" of mathematics anxiety. Since many variables are evident in each case, one specific solution is not possible. However, recognition of the disorder and a willingness to combat the problem offer a beginning for sufferers of math anxiety. Teachers can have a direct impact on alleviating the problem. In fact, many teachers may have endured math anxiety themselves. Hopefully, past experiences of this nature can facilitate help for their students. In

some situations, additional assistance may be necessary. Specific programs offered by schools, or local clinics, may prove beneficial in diagnosing and labeling exact causes of math anxiety.

RECOMMENDATIONS

It is recommended that:

1. Educators work toward individualizing mathematics instruction.
2. Schools improve methods used to schedule students into math courses.
3. Teachers be required to attend a workshop, or seminar on mathematics anxiety.
4. More treatment programs for math anxiety be offered by schools and clinics for students.
5. Teachers strive to eliminate sex-role stereotyping and "math-mind" myths.
6. Educators provide a positive and relaxed classroom environment.
7. The relevance of mathematics be taught and applied, not only in math courses, but other subjects too.
8. Teachers emphasize understanding and developing thought process for problem solving.
9. Educators work toward improving student study skills.
10. Teachers supply students with detailed and explicit examples when teaching math topics.
11. Research be continued to determine reasons for the formation of math anxiety, as well as methods to eliminate the disorder.

BIBLIOGRAPHY

Alexander, Livingston, and Robert Cobb. "Identification of the Dimensions and Predictors of Math Anxiety among College Students." Paper presented at the Annual Meeting of the Mid-South Educational Research Association (New Orleans, LA, November 16, 1984). (9,25)

Anick, Constance M., Thomas P. Carpenter, and Carol Smith. "Minorities and Mathematics: Results From The National Assessment of Education Progress." The Mathematics Teacher 74.6 (September 1981): 560-566. (23,29)

Bander, Ricki S., Richard K. Russell, and Kathy P. Zamostny. "A Comparison of Cue-Controlled Relaxation and Study Skills Counseling in the Treatment of Mathematics Anxiety." Journal of Education Psychology 74.1 (February 1982): 96-103. (22,29)

Betz, Nancy E. "Prevalence, Distribution, and Correlates of Math Anxiety in College Students." Journal of Counseling Psychology 25.5 (September 1978): 441-448. (1,13,27)

Brush, Lorelei R. "Some Thoughts for Teachers on Mathematics Anxiety." Arithmetic Teacher 29.4 (December 1981): 37-39. (12,26)

Buckley, Patricia A., and Sheila C. Ribordy. "Mathematics Anxiety and the Effects of Evaluative Instructions on Math Performance." Paper presented at the Mid-western Psychological Association (Minneapolis, MN, May 6-8, 1982). (5,6,25)

Bulmahn, Barbara J., and David M. Young. "On the Transmission of Mathematics Anxiety." Arithmetic Teacher 30.3 (November 1982): 55-56. (23,29)

Burton, Grace M. "Revealing Images." School Science and Mathematics 84.3 (March 1984): 199-207. (2,17,27)

Cartledge, Carolyn M. "Improving Female Mathematics Achievement." 1984. Research Report, Columbus College. (22,29)

Chisholm, Carol. "Correlates of Math Avoidance Responsible for Filtering Individuals from Math/Science Areas." June 1980. Master's Thesis, Townson State University. (4,8,25)

Dew, Kathleen H., John P. Galassi, and Merna D. Galassi. "Mathematics Anxiety: Some Basic Issues." Journal of Counseling Psychology 30.3 (July 1983): 443-446. (14,27)

Dew, K. M. Harriss, John P. Galassi, and Merna D. Galassi. "Math Anxiety: Relation with Situational Test Anxiety, Performance, Physiological Arousal, and Math Avoidance Behavior." Journal of Counseling Psychology 31.4 (October 1984): 580-583. (5,12,26)

Fennema, Elizabeth, and Thomas P. Carpenter. "Sex-Related Differences In Mathematics: Results From National Assessment." The Mathematics Teacher 74.7 (October 1981): 554-559. (17,27)

Fulkerson, Katherine F., John P. Galassi, and Merna D. Galassi. "Relation Between Cognitions and Performance in Math Anxious Students: A Failure of Cognitive Theory?" Journal of Counseling Psychology 31.3 (July 1984): 376-382. (15,27)

Good, Carter V., Editor, Dictionary of Education, 3rd edition, McGraw-Hill Book Company, New York, 1973. (4)

Gourgey, Annette F. "Development of a Scale for the Measurement of Self-Concept in Mathematics." 1982. Research Report, New York University. (7,25)

Hackett, Gail. "Role of Mathematics Self-Efficacy in the Choice of Math Related Majors of College Women and Men: A Path Analysis." Journal of Counseling Psychology 32.1 (January 1985): 47-56. (5,10,26)

Hodges, Helene L. B. "Learning Styles: Rx for Mathophobia." Arithmetic Teacher 30.7 (March 1983): 17-20. (4,21,28)

Kelly, William P., and William K. Tomhave. "A Study of Math Anxiety/Math Avoidance in Preservice Elementary Teachers." Arithmetic Teacher 32.5 (January 1985): 51-53. (5,15,27)

Llabre, Maria M., and Eduardo Suarez. "Predicting Math Anxiety and Course Performance in College Women and Men." Journal of Counseling Psychology 32.2 (April 1985): 283-287. (13,27)

Morris, Janet. "Math Anxiety: Teaching To Avoid It." Mathematics Teacher 74.6 (September 1981): 413-417. (2,20,28)

Oberlin, Lynn. "How To Teach Children To Hate Mathematics." School Science and Mathematics 82.3 (March 1982): 261. (11,26)

Resnick, Harvey, John Viehe, and Sanford Segal. "Is Math Anxiety a Local Phenomenon? A Study of Prevalence and Dimensionality." Journal of Counseling Psychology 29.1 (January 1982): 39-47. (8,25)

Reyes, Laurie H. "Affective Variables and Mathematics Education." Elementary School Journal 84.5 (May 1984): 558-581. (4,7,25)

Richardson, Frank C., and Richard M. Suinn. "The Mathematics Anxiety Rating Scale: Psychometric Data." Journal of Counseling Psychology 19.6 (November 1972): 551-554. (4,24,29)

Rounds, James B. Jr., and Darwin D. Hendel. "Measurement and Dimensionality of Mathematics Anxiety." Journal of Counseling Psychology 27.2 (March 1980): 138-149. (9,25)

Scholfield, Hilary L. "Sex, Grade Level, and the Relationships between Mathematics Attitude and Achievement in Children." Journal of Educational Research 75.5 (May/June 1982): 280-284. (16,27)

Sherard, Wade H. "Math Anxiety in the Classroom." The Clearing House 55.3 (November 1981): 106-110. (1,19,28)

Siegel, Ross G., John P. Galassi, and William B. Ware. "A Comparison of Two Models for Predicting Mathematics Performance: Social Learning Versus Math Aptitude-Anxiety." Journal of Counseling Psychology 32.4 (October 1985): 531-538. (16,27)

Sovchik, Robert L. J. Meconi, and Evelyn Steiner. "Mathematics Anxiety of Preservice Elementary Mathematics Methods Students." School Science and Mathematics 81.8 (December 1981): 643-648. (11,26)

Suinn, Richard M., and Ruth Edwards. "The Measurement of Mathematics Anxiety: The Mathematics Anxiety Rating Scale For Adolescents-MARS-A." Journal of Clinical Psychology 38.3 (July 1982): 576-580. (4,24,29)

Tobias, Sheila. "Math Anxiety: What You Can Do About It." Today's Education 69.3 (September-October 1980): 26-29. (2,4,10,25)

Tobias, Sheila. "Math Anxiety: Why Is A Smart Girl Like You Counting On Your Fingers?" Ms. 5.3 (September 1976): 56-59+. (6,26)

Widmer, Connie C., and Annette Chavez. "Math Anxiety and Elementary School Teachers." Education 102.3 (Spring 1982): 272-276. (1,18,28)

Wood, Dorothy F. "The Fourth R-Wrong." The Mathematics Teacher 75.9 (December 1982): 728-730. (21,28)

Wright, Donald E., and Loretta Diane Miller. "Math Anxiety: A Research Report." Paper presented at the Annual Meeting of the Mid-South Educational Research Association (Lexington, KY, November 10, 1981). (14,27)

STUDENT QUALIFICATIONS

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Qualifications To Undertake The Study	I have witnessed students suffering math anxieties while teaching both high and low levels of mathematics at the secondary level for seven and one-half years. I have completed the necessary undergraduate and graduate courses that permit enrollment to this course of study (S591).
Reason For My Interest In This Topic	I am interested in finding the possible causes of math anxiety, ways to recognize its presence, and solutions for easing or eliminating the resulting consequences.